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A Comparison of Sprayer Technology in Ginseng

June 12, 2000

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Introduction



The limiting factors in ginseng production in Ontario are losses due to root rot and foliar disease. With the exception of root rot caused by the soil fungus, *Cylindrocarpon destructans*, growers have the fungicide tools necessary to keep diseases at bay.

Root rot can result in lesions that downgrade the market value of the root or even decay the entire root resulting in lower overall yields. Direct damage to the root is dramatic and usually obvious.



Losses due to foliar disease are more subtle. Ginseng roots increase in size each year from mid-July through September. A three-year-old garden can increase in yield by 500 lbs per acre during such a growth period. Foliar disease that strikes a garden before mid-July can dramatically reduce this weight gain.

These losses occur as a result of stem canker, loss of photosynthetic surface due to lesions, and defoliation caused by the fungi *Alternaria panax* and *Botrytis cinerea*. The initial focus of foliar disease in a garden is usually the stem. If fungi are left unchecked, leaf disease and head blight will follow. Defoliation can occur within seven days of infection in an untreated garden. Once foliar disease becomes established in a garden, growers are forced into a 7-10 day treatment schedule. Control of diseases on the stem and in the leaf canopy depends to a large extent on the use of appropriate fungicides and on adequate coverage of the plant surface to be protected.

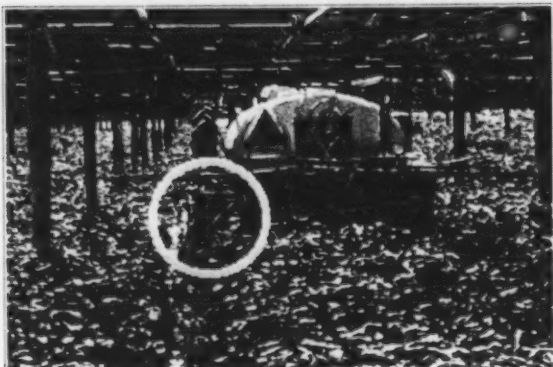
This infosheet is a discussion of trials undertaken in the summer of 1998. Three sprayers were tested in a three-year-old ginseng garden. The evaluation was carried out by having each sprayer apply a red food, drug and cosmetic dye to the ginseng garden where paper discs were strategically placed within the plant canopy. Using computer image analysis on the paper discs, spray deposition was statistically analysed and

expressed in terms of percent coverage.

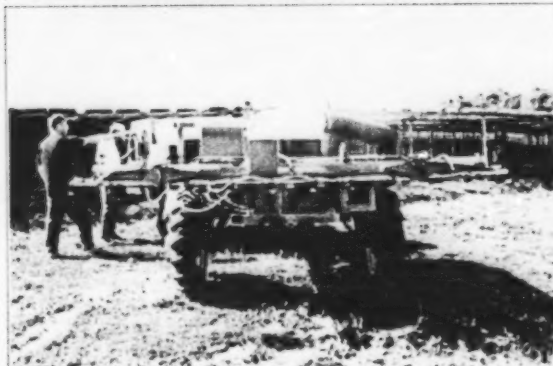
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Ginseng Sprayers

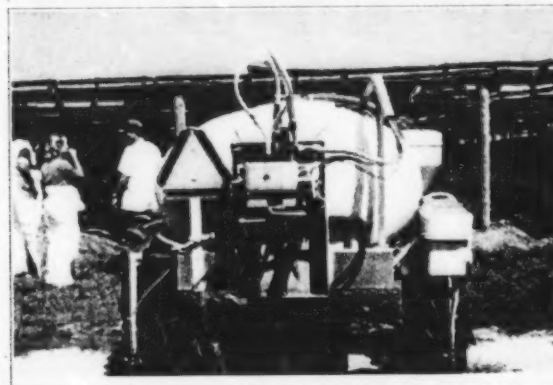
Three sprayer types are popular among ginseng growers: the hydraulic boom with drop arms; the air-assisted hydraulic boom; and the Casotti (oscillating) sprayer. Applications were made using commercial sprayers representative of each of these types. Pressure, 150 p.s.i. for boom and air assist and 450 p.s.i. for Casotti, was set at recommended levels. Driving speed was consistent at 3 mph. The variables in this experiment were sprayer type and spray volume. Spray volumes used were 60, 120 and 180 gallons per acre. All equipment was calibrated using a predetermined protocol.



Hydraulic boom sprayer with drop arms used in ginseng trials. Note the drop arms (yellow circle) behind the tires. Coverage extends over the width of one bay. Note how the area of red dye covers half the bed in the post rows.



Air assisted hydraulic sprayer used in ginseng trials. Boom width is similar to that of the boom with drop arms. Coverage extends over the width of one bay.

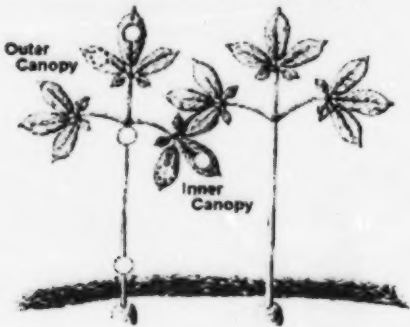


Casotti sprayer used in ginseng trials. Note the oscillating nozzles at the rear of the spray tank. Coverage extends over three bays: the driving bay and one bay on either side. Use of this type of sprayer reduces both time and fuel used in product application.

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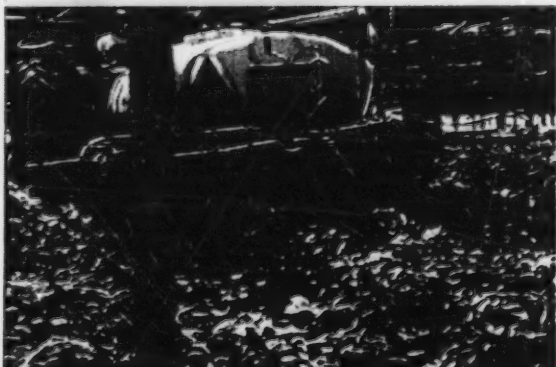
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Data collection

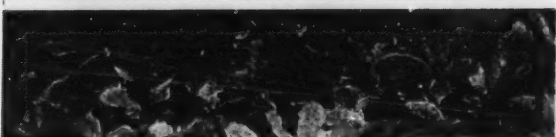
Disk Placement on Ginseng  Illustration by: TIFFANY WYSDOW	To measure the deposition of spray material on ginseng leaves and stems we used 19mm white adhesive discs strategically placed on 12 plants throughout the test area. The discs on the lower leaf surface are shown as dotted circles. Inner canopy leaves were chosen based on their position below other leaves. For analysis, a 115 sq. mm area was captured from each disc electronically under 30X magnification using a black & white high resolution video camera. Each image was analysed for percent area covered using 'Bioscan Optimas' image analysis software. A droplet diameter of 25 microns could be indentified using this system.
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White paper discs were placed within the plant canopy in areas representing the common focal points of infection. Discs were placed on the upper and lower surface of leaves in the outer canopy; on the upper and lower surface of leaves in the inner canopy; and in two places on the stem - below the junction of the stem and leaves and at the base of the stem. The discs were adhesive and stuck firmly to the leaf surfaces. Discs for the stem were attached to rubber tubing and the tubing placed around the ginseng stem.



A red food, drug and cosmetic dye was applied with water at three different volumes for each of the three sprayers.

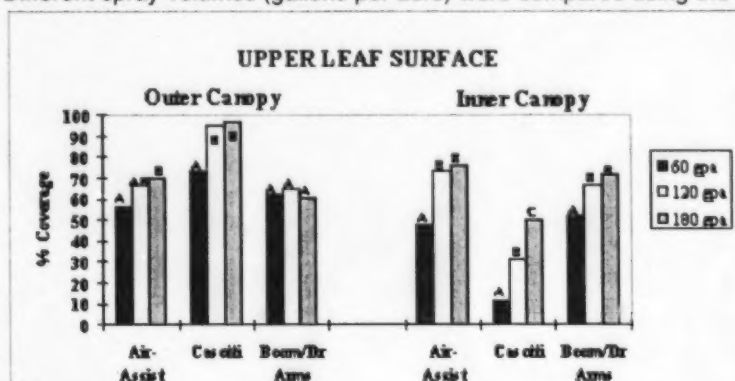


Not all sprayers performed the same. In the test at the left you can see where the red dye did not cover all of the foliage evenly. This was reflected on the paper discs as well.

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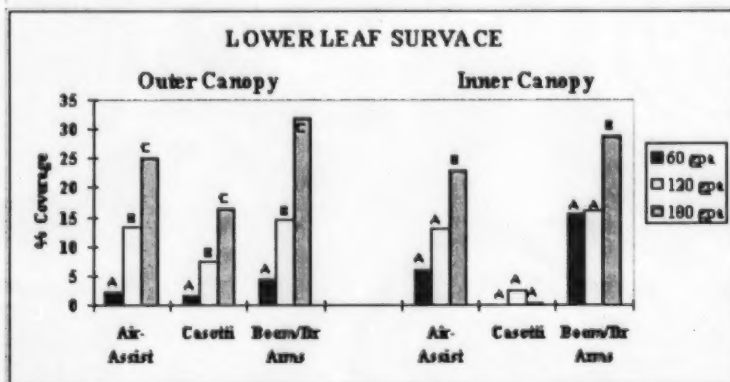
Results

Different spray volumes (gallons per acre) were compared using the three sprayer types.



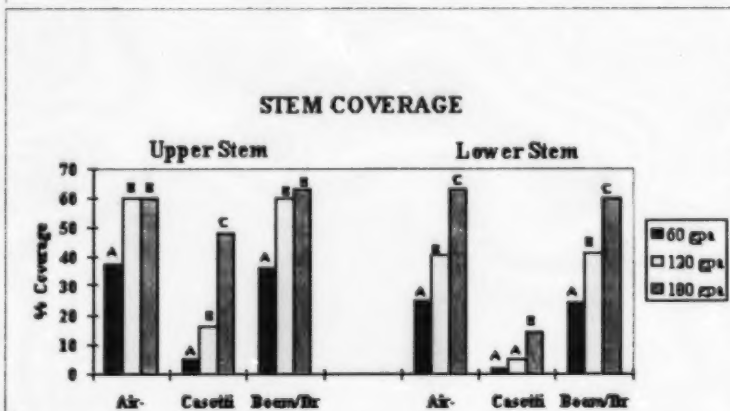
On the **outer leaf canopy**, upper leaf surface, volume did not affect deposition using the boom with drop arms. Both the Casotti and the air assisted boom performed better at the two higher water volumes.

On the **inner canopy**, upper leaf surface, both the air-assisted boom and the boom with drop arms performed better at the two higher volumes. Deposition using a Casotti sprayer increased as water volume increased.



On the **outer canopy**, lower leaf surface, spray deposition improved as water volume increased for all sprayer types.

On **inner canopy** leaves, lower leaf surface, deposition improved only at the highest water volume for both the air assisted boom and the boom with drop arms. Spray deposition by the Casotti was low at all water volumes tested.



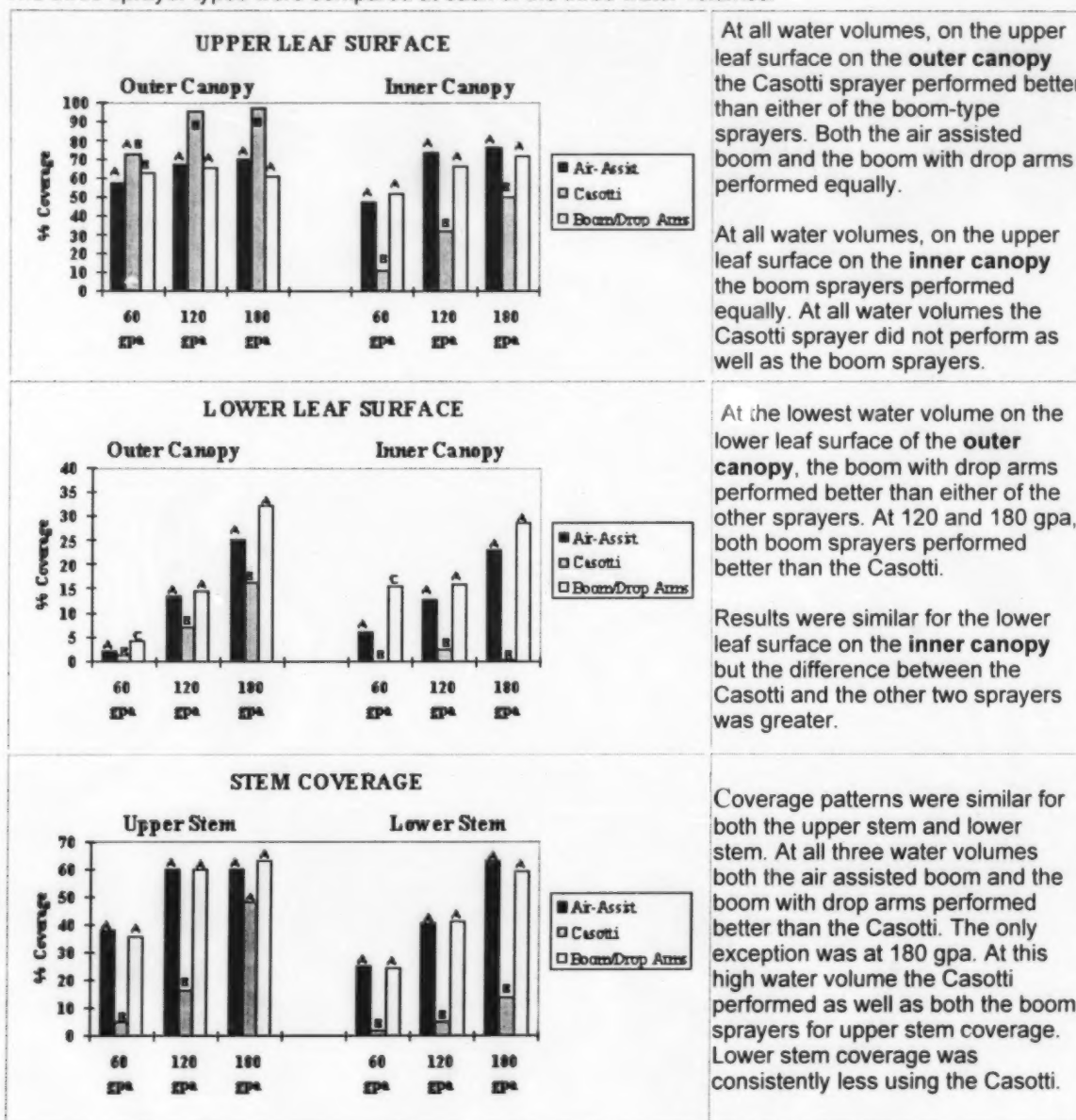
Coverage on the **upper stem** using the boom with drop arms and the air assisted boom improved when the water volume increased from 60 to 120 gpa and did not increase further when the water volume was increased from 120 to 180 gpa. With the Casotti, coverage increased as water volume increased.

Coverage of the **lower stem** increased as water volume increased for both boom sprayers. Coverage did not increase using

the Casotti sprayer between 60 and 120 gpa but it did increase when the water volume was increased to 180 gpa.

These results indicate that inner canopy leaves, especially on the lower surface and lower stems are at risk of the development of uncontrolled infection when a Casotti sprayer is used as we used it. These are the areas of gardens where disease frequently occurs. For most of the growing season the area of the lower stem exists in a microclimate of high humidity. Most of the disease outbreaks that occur in ginseng gardens can be traced back to poor coverage on the lower stems and the underside of the leaves.

The three sprayer types were compared at each of the three water volumes.



With the single exception of coverage of the upper leaf surface on the outer canopy, the Casotti sprayer gave significantly less coverage than either the air-assisted boom or the conventional boom with drop arms at corresponding water volumes and sample locations.

With the statistical information obtained from this project, it has made it possible to validate assumptions that a proper selection of sprayer type and water volume will have a large impact on spray coverage throughout all parts of the plant canopy. With the single exception of coverage of the upper leaf surface on the outer canopy, the Casotti sprayer gave significantly less coverage than either the air assisted boom or the boom with drop arms at corresponding water volumes and sample locations. It is interesting that despite the newer technology of the air assisted boom there was no significant difference in coverage between the air assisted boom and the conventional boom with drop arms except at 60 gpa on the lower leaf surface. This study also showed that increasing the water volume does not necessarily increase coverage.

The importance of coverage in the control of foliar diseases cannot be understated. It is the first factor that should be considered when protection fails. Frequent sprayer calibration will help to ensure that your sprayer performs at it's optimum level. If coverage is adequate, and the choice of fungicide appropriate, but disease remains uncontrolled, then resistance should be considered.

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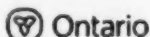
This Infosheet was authored by: [Jan Schooley](#), OMAFRA Ginseng and Medicinal Herb Specialist

For more information... regarding spray application technology in ginseng in Ontario contact [Paul Goodwin](#)

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Last Updated: July 3, 2001